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NEW WEIGHTS AND MEASURES HANDBOOK

Handbook H26, Weights and Measures Administration, by Ralph W. Smith, released a short time ago, presents a general discussion of weights and measures supervisory work, as this should be carried on by State and local regulatory officers. Beginning with a statement of the functions of the weights and measures officials and a tabulation of the present organization of weights and measures administration in the United States, part I of the text proceeds to a consideration of a model form of weights and measures organization, fee and licensing systems, essential elements of the law, the training of officials, and other general subjects. Part II deals with those activities of the official which have to do with scales, weights, measures, etc., treating separately such topics as standards and equipment, and the testing, sealing, rejection, adjustment, and repair of commercial equipment.

The supervisory side of weights and measures administration, as distinguished from the mechanical side, is discussed in part III; the education of the users of commercial equipment and of the public, try-out inspections, the investigation of complaints, and prosecutions are among the subjects treated. Part IV is devoted to systems of weights and measures records. Three appendixes are included, the first presenting Federal weights and measures laws and regulations, the second giving the full texts of the three forms of the Model State Law on Weights and Measures, and the last listing the specific items of standards and equipment recommended for State and local departments of weights and measures.

The Handbook has been prepared to provide basic information for weights and measures officials, to encourage the extension of weights and measures supervision to communities not now enjoying that protection by providing facts for the study of the subject by consumer groups and others, and to supply data for the enactment of laws and the establishment of adequate regulatory agencies in the weights and measures field. Copies of H26 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 75 cents each.

ACRYLIC RESINS FOR DENTURES

For years the dentist has been seeking material of lifelike appearance which could be used in making artificial dentures and which would not deteriorate in service. The nearest approaches to this ideal base for dentures are methyl methacrylate resin and a

[1] Published with approval of the Director of the Budget.

copolymer of methyl methacrylate, vinyl chloride, and vinyl acetate. A recent report by Sweeney, Paffenbarger, and Beall (research associates of the American Dental Association stationed at the Bureau) gives properties of these two resins and of other organic materials which have been or are being used as the base material in dentures. All told, some 30 materials were investigated. Such properties as water sorption, solubility, color stability, strength and stiffness in transverse bending, hardness, shrinkage during curing, and dimensional stability on wetting and drying were measured. The data on these properties were used as a basis for the American Dental Association's Tentative Specification No. 12 for Denture Base Materials.

The complete report will be published in the January number of the Journal of the American Dental Association.

POLAROGRAPHIC STUDIES OF SUGAR ACIDS

In the Journal of Research for January (RP1448), Harry Matheson, Horace S. Isbell, and Edgar Reynolds Smith describe the polarographic method of studying the polyhydroxymonocarboxylic acids, often called the "sugar acids," and their lactones, lactides, and other condensation products. The approach to equilibrium between the aldonic acids and their lactones is shown by progressive changes with time in the relative heights of the hydrogen and lactone "waves" on current-voltage curves, as the acid or lactone is allowed to stand in dilute acqueous solution.

Freshly prepared solutions of the aldonic acids give the ordinary hydrogen wave, but do not give waves which correspond to the reduction of the carboxyl group. When a solution containing an aldonic acid is allowed to stand, the wave caused by hydrogen ion decreases, and a wave due to the gamma lactone appears. In the presence of oxygen, a wave apparently caused by some substance produced by the interaction of the sugar acid, mercury, and oxygen, forms at about —1.1 volts. The formation of this wave is accompanied by a corresponding decrease in the hydrogen wave.

Freshly prepared solutions of the delta lactones of the aldonic acids give waves at about —2.3 volts, with respect to a mercury anode, which appear to result from the reduction of the lactones. The heights of these waves decrease with time until, after several hours, they disappear. The absence of an appreciable delta lactone wave in a 0.01 *M* aqueous solution of an aldonic acid shows that the position of the equilibrium between the free acid and the delta lactone is far toward the free acid.

The gamma lactones of the aldonic acids give polarographic waves at potentials slightly higher than the delta lactones. When a solution containing a gamma lactone is allowed to stand, the height of the gamma lactone wave decreases, while a wave corresponding to the reduction of the hydrogen ion appears. The inflection points for the gamma lactone waves vary only slightly with the configuration of the groups comprising the lactone structure. This small variation in the inflection points shows a regularity which indicates that the stereomeric positions of the hydroxyl groups are of importance. When the hydroxyl of carbon 2 and the residual carbon group attached to carbon 4 are in the *cis* position, the reduction potential seems to be higher than it is when these groups are in the *trans* position.

EXPANSIVITY OF A VYCOR BRAND GLASS

A study of a new glass (96 percent silica, glass No. 790) used in heat-resisting glassware was made a short time ago by James B. Saunders, and the results are given in the Journal of Research for January (RP1445). The expansivity of the glass is compared with that of fused quartz, using a slight modification of Fizeau's method for determining very small differences in expansion. This method has the advantage of permitting the use of relatively long samples, the procurement of very sharp and well-defined interference bands, and the almost complete elimination of the correction arising from changes in the refractive index of air with changing temperature.

The results indicate that the No. 790 glass has a coefficient of expansion approximately twice that of fused quartz at room temperature, an expansivity equal to fused quartz at approximately 300° C (572° F), and an expansivity less than one-half of that for fuzed quartz in the neighborhood of 700° C (1,292° F).

ELASTIC PROPERTIES OF ALLOY CAST IRONS

A knowledge of the elastic properties of cast iron is important in connection with the design of structural parts, such as piston rings, cylinder liners, etc.

This is particularly true at the present time, when emergency conditions have greatly increased its use. Therefore, A. I. Krynitsky and C. M. Saeger, Jr., have extended their previous study of elastic properties to inculude three types of alloy cast iron. Test bars 1.2 inches in diameter and 21 inches long were made and tested for transverse strength, deflection, Brinell hardness, and microstructure. The metal was melted in a high-frequency induction furnace of the tilting type. It was heated before casting to the maximum temperatures of 1,400°, 1,500°, 1,600°, and 1,700° C. (2,552°, 2,732°, 2,912°, and 3,092° F). Test bars were vertically cast, bottom poured in green sand molds at a temperature 100°, 150°, 200°, and 250° C (180°, 270°, 360°, and 450° F) above the liquidus.

As reported in RP1447 in the Journal of Research for January, a comparison of the results for alloy irons with those of plain carbon irons examined previously indicates that the relative modulus of elasticity of some carbon irons is higher than those of the alloy irons investigated.

The beneficial effect of the maximum heating temperature on the moduli of rupture and elasticity was more pronounced for the plain carbon irons than for alloy irons. The effect of pouring temperature for both plain carbon and alloy irons was about the same, i. e., these properties showed a tendency to increase with a decrease in pouring temperature.

TEE-BEND TEST FOR WELDING QUALITY OF STEELS

The marked increase in the use of welding in place of riveted construction has involved more than a simple substitution of one method for the other. A design for riveted construction is not necessarily equally suitable for welding; in fact different designs are often necessary for identical structures fabricated by the two methods. All metals are not equally satisfactory for welding, and different techniques are necessarily employed for making the same types of joints in different metals. In selecting the metal that will best meet the strength requirements of a given structure to be assembled by welding, the welding quality of the metal (within the limitations imposed by the practicability of the welding method) is of prime importance.

The welding of medium steel offers little difficulty, provided proper attention is given to design and welding technique. However, the use of high-tensile, low-alloy steels to reduce size and weight of members often creates difficulties because of the differences in welding qualities of the steels.

In a cooperative investigation authorized by the Bureau of Ships, U. S. Navy Department, and conducted by George A. Ellinger, A. G. Bissell, and Morgan L. Williams at the National Bureau of Standards, the welding qualities of 18 commercial steels were studied by bending fillet-welded tee specimens of the steels in special jigs. Six of these steels were also welded and tested at subnormal temperatures as low as −20° F. The welds in the specimens were not machined.

The angle of bend at maximum load and the type of fracture in the bend test were the governing factors in comparing the welding qualities of the steels. The data were evaluated by means of a special method of statistical analysis.

As reported in the Journal of Research for January (RP1444), steels which contained large numbers of nonmetallic inclusions generally had lower welding qualities than those which contained few inclusions. The high-temperature grain size and grain-coarsening temperatures apparently had little effect on the welding qualities of these steels.

Steels normalized at 1,650° F. before welding had higher welding qualities, probably due to more homogeneous structures of the metals.

Hardness surveys indicated that none of the steels hardened appreciably upon welding and that there was no correlation between hardness properties and welding qualities as determined by this investigation. Likewise, no good correlation was found between the ordinary tensile properties (yield point, tensile strength, and elongation) and welding qualities of these steels.

Steels welded at low temperatures usually had lower angles of bending and a higher percentage of failures in the parent metal than those welded at room temperature. However, the temperature at which the tests were made apparently had more effect on the results obtained than the temperature of the plates when welding was started.

Bend tests made on specimens of the same steel with cast fillets and with welded fillets proved that the test was not a function of the geometrical shape of the specimen but was an indication of the welding quality of the steel. Likewise the width of specimen is not critical and within certain limits does not appreciably affect the results of the bend tests.

COATINGS FOR PROTECTING METALS FROM SOIL CORROSION

Conclusions drawn from previous inspections of various metallic and nonmetallic coatings exposed to soils are generally confirmed by the results of recent inspections reported by K. H. Logan in a paper (RP1446) in the January Journal of Research. The protection of steel by zinc coatings depends on the thickness of the coating and is not appreciably affected by the kind of base metal. In a group of mildly corrosive soils, a specially applied coating of approximately 3 ounces of zinc per square foot prevented pitting almost entirely for an exposure period of 16 years, the duration of the test. In a group of generally corrosive soils, however, a commercial 3-ounce coating did not entirely prevent pitting over a 2-year period. This result is not consistent with previous tests of heavy zinc coatings in corrosive soils, in which pitting was almost entirely prevented for 10 years, the maximum period of exposure. The suggestion is advanced that uniformity is a prerequisite for adequate protection by zinc coatings in soils.

Lead coatings applied to iron and steel have not proved adequate for protection underground. Since the potential of lead is cathodic to that of iron, lead cannot protect iron or steel in the manner that these metals are protected by zinc. As the rate of corrosion of lead is appreciable under many soil conditions, a continuous layer of lead isolating steel from its environment usually cannot be maintained.

A coating of tin was of little benefit in protecting copper from corrosion in soils. Under certain conditions one or more of the tin-copper alloy layers may be cathodic to copper, a condition which would accelerate corrosion.

The condition and protective value of a variety of experimental coatings after limited periods of exposure are discussed. These coatings include various synthetic resins, chiefly of the phenolic group, various types of rubber and synthetic rubber, vitreous enamel, etc. In this group of coatings, a vitreous enamel and two hard-rubber coatings provided complete protection for 7 years. A phenolformaldehyde (Bakelite) coating, consisting of several coats of Bakelite varnish, with each coat baked on, provided satisfactory protection for 2 years, the extent of the exposure.

CATHODIC PROTECTION OF PIPE LINES

In Technical News Bulletin 296 (December 1941) a résumé was given of the present status of cathodic protection of pipe lines. A paper on this subject was presented by Kirk H. Logan at the Second Annual Water Conference of the Civil Section, Engineers' Society of Western Pennsylvania, on November 3, 1941. A limited number of mimeographed copies of this paper are now available and will be sent on request to applicants who can show a real need for the information. Requests should be addressed to: Underground Corrosion Section, National Bureau of Standards, Washington, D. C.

WATER-DISTRIBUTING SYSTEMS FOR BUILDINGS

A common and exasperating experience in the average home is the complete or nearly complete failure of the water supply on the upper floor caused by the simultaneous use of several fixtures on the lower floor, thus overloading the water-distributing system in the building. The difficulty is due to the fact that the sizes of the building supply main and of the branches for a small dwelling are rarely designed but are selected by a hit-or-miss process which leads to unsatisfactory service in times of maximum water use in the building.

Even if the pipe sizes are chosen to give an adequate supply of water when the system is new, the supply may become inadequate in the course of time because of the deterioration of the inner surface of the pipes due to corrosion or caking by the water that flows in them. This deterioration leads to increased resistance, resulting in a decrease in the rate of flow that can be obtained at any given fixture.

Different water supplies vary markedly in their caking and corroding effects on pipes. In some parts of the United States, hot-water pipes of the most commonly used material must be renewed annually on the average, whereas in other localities the same kind of pipe may give good service for 20 years or more. Under most conditions, satisfactory service can be assured over a reasonable period of years by using pipes of suitable material and by selecting large enough pipe diameters for the various parts of the system.

Building Materials and Structures Report BMS79, recently released, is intended to make available for practical use a method of procedure for sizing the pipes properly in designing building water-distributing systems. It also gives information that will aid in choosing proper materials for use in the piping system, a subject on which little has been published in usable form.

The paper is one of a series which will deal with all aspects of the water supply and drainage in buildings. An earlier paper (BMS65; 10 cents) in the series described a practical method of estimating the maximum rate of flow of water in a building water-supply system based on the number and kind of plumbing fixtures installed in the building.

Copies of BMS79 are obtainable at 15 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

PAVING CONCRETE COMPACTED BY VIBRATION

Limited tests of the use of vibration in placing concrete pavement have indicated that if the concrete is effectively vibrated the strength can be increased about 10 percent, or the same strength can be obtained with a saving of about 10 percent in cement.

Recently, experimental procedures were tried with commercial vibrators on a section of pavement constructed in the District of Columbia. F. B. Hornibrook and George L. Pigman, of the Bureau's staff, made measurements of the amplitudes of vibration during the compaction of the paving concrete, using a measuring apparatus developed at the Bureau and described in J. Research NBS 20, 707 (May 1938) RP1101.

It was found that the amplitude was at a maximum immediately adjacent to the vibrating elements submerged in the concrete. The amplitude decreased very rapidly with increase in distance from the vibrator.

The area effectively covered by both vibrators was limited to a region very close to each element. Vibration could be detected at a considerable distance from the vibrator, but it was not of sufficient amplitude to affect the concrete visibly.

EARTH-WALL CONSTRUCTIONS

Building Materials and Structures Report BMS78, recently released, describes tests on adobe, bitudobe, monolithic terracrete, terracrete-block and rammed-earth wall construction. The specimens, constructed with the cooperation of The Office of Indian Affairs and the National Youth Administration, were subjected to structural, heat-transfer, and water-permeability tests. Sixty structural specimens were subjected to compressive, transverse, concentrated, impact, and racking loads, simulating conditions to which the elements of a house are subjected in actual service. The deformations under load and the sets after its removal were measured for each increment of load.

Five heat-transfer specimens were subjected to a temperature differential that might occur in service, and five water-permeability specimens were tested under conditions simulating exposure to a heavy wind-driven rain.

The price of BMS78 is 20 cents. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C.

METHODS OF TESTING BELTING LEATHER

The physical and chemical properties of 17 samples of flat, vegetable-tanned commercial belting leather have been studied recently by Robert B. Hobbs and Philip E. Tobias, of the Bureau's Leather Section, in connection with a proposed revision of Federal Specification KK–B–201. This specification requires that the stretch at a stress of 2,500 lb/in.^{2} be determined on the specimens used for the tensile-strength tests, but does not state whether the machine should be stopped for this measurement. The results of this study indicate that the measurement should be made while the machine is running.

A direct development of the work is a new, simplified method for testing the cementing of laps and plies. The necessary equipment consists of two pairs of jaws, one fixed and the other movable, and suitable weights. The former method required a type of testing machine which was available only in a few laboratories.

In general, the physical characteristics of the samples tested conformed fairly well to the specification, except that 6 of the 17 had too much stretch.

Of the 15 samples subjected to chemical tests, 6 contained percentages of grease which were not within the limits of the specification, and 4 contained too much acid. The latter difficulty might

be overcome by adding small amounts of buffer salts to the leather during the manufacturing process.

KNOCK-RATING TESTS AT VARIOUS ALTITUDES

Laboratories making knock-rating tests of gasolines are located at various altitudes. Since the results are directly affected by barometric pressure, the tests run in these laboratories are not consistent with each other. This has been a source of both inconvenience and error for some years, during which attempts have been made, but with only partial success, to reconcile the results. Recently a program of comparative tests was completed in the Bureau's altitude laboratory where air pressures are readily controlled. Engines and observers were assigned by some of the oil companies. The results are gratifying, as it is found that a very simple formula can be used with high accuracy to correct the results of tests run at any altitude below 10,000 feet to correspond with those obtained at any other altitude.

NEW AND REVISED PUBLICATIONS ISSUED DURING DECEMBER 1941

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 27, number 6, December 1941 (RP1435 to RP1443, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Title page, contents, and corrections for volume 26, Journal of Research of the National Bureau of Standards (RP1354 to RP1397, inclusive). Free on application to the Bureau.

Research Papers [2]

[Reprints from September, November, and December 1941 Journal of Research]

RP1418. Evolution of carbon dioxide and water from vegetable-tanned leathers at elevated temperatures. Joseph R. Kanagy. Price 5 cents.

RP1430. Reflection-transmission relationships in sheet materials. Herbert F. Launer. Price 5 cents.

RP1436. Use of chlorites for treating raw sugars. Horace S. Isbell. Price 5 cents.

RP1442. An improvement in the method for dissolving cellulose in cuprammonium solution for fluidity measurements. Ralph T. Mease. Price 5 cents.

Simplified Practice Recommendations [2]

R160–41. Forged hatchets. (Supersedes R160–37.) Price 5 cents.

Building Materials and Structures Reports [2]

[Persons who wish to be notified of new publications in the Building Materials and Structures series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

BMS78. Structural, heat-transfer, and water-permeability properties of five earth-wall constructions. Herbert L. Whittemore, Ambrose H. Stang, Elbert Hubbell, and Richard S. Dill. Price 20 cents.

BMS79. Water-distributing systems for buildings. Roy B. Hunter. Price 15 cents.

Technical News Bulletin [2]

Technical News Bulletin 296, December 1941. Price 5 cents. Annual subscription 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC670. List of simplified practice recommendations. (Supersedes LC654.)

LC673. Optical instruments, refractometry, and optical properties of glass; Publications by the staff of the National Bureau of Standards. (Supersedes LC571.)

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

Installation requirements for head meters. Howard S. Bean. Heating, Piping and Air Conditioning (Keeney Publishing Co., 6 No. Michigan Ave., Chicago, Ill.) **13,** 744 (December 1941).

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (to addresses in the United States and its possessions and to countries extending the franking privilege; other countries 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government unless otherwise stated. Requests should be sent direct to the publishers.

For bigger and better weights and measures supervision. Hugh G. Boutell. Michigan Sealers Bulletin (George W. Martin, Editor, 370 Vester Ave., Ferndale, Mich.) **14,** No. 3, 7 (November 1941).

A physical photometer. Ray P. Teele. J. Optical Soc. Am. (175 Fifth Ave., New York, N. Y.) **27,** 217 (September 1941).

Methods of designating color. Deane B. Judd. One of five papers comprising a symposium on color standards and measurements. Bul. Am. Ceramic Soc. (2525 No. High St., Columbus, Ohio) **20,** 375 (1941).

Progress report on the hydrocarbons in the kerosine fraction of petroleum. API Research Project 6. Frederick D. Rossini and Beveridge J. Mair. Proc. Am. Petroleum Institute (50 West 50th St., New York, N. Y.) **22,** No. III (1941); Oil and Gas J. (Tulsa, Okla.) **40,** No. 26, 129 (1941); Refiner and Natural Gasoline Manufacturer (Gulf Pub. Co., 3301 Buffalo Drive, Houston, Texas) **20,** No. 11, 494 (1941).

Estimation of aldehyde groups in hydrocellulose from cotton. Albert R. Martin, Leonard Smith, Roy L. Whistler, and Milton Harris. Am. Dyestuff Reporter (Howes Publishing Co., 440 Fourth Ave., New York, N. Y.) **30,** 628 (November 10, 1941).

Nature of the resistance of wool to digestion by enzymes. Walton B. Geiger, Wilbur I. Patterson, Louis R. Mizell, and Milton Harris. Am. Dyestuff Reporter **30,** 659 (November 24, 1941).

Testing adhesiveness of gummed tape. C. G. Weber. Modern Packaging (Chaning Building, 42d St., and Lexington Ave., New York, N. Y.) **15,** No. 4, 66 (December 1941).

Evolution of carbon dioxide and water from vegetable-tanned leathers at elevated temperatures. Joseph R. Kanagy. J. Am. Leather Chemists Assn. (143 West 20th St., New York, N. Y.) **36,** 609 (October 1941).

Pitting and its effect on the fatigue limit of steels corroded under various conditions. D. J. McAdam, Jr. and G. W. Geil. Preprint No. 33, Am. Soc. for Testing Materials (260 So. Broad St., Philadelphia, Pa.) (June 23, 1941).

The influence of stress on the corrosion pitting of steel in distilled water. D. J. McAdam, Jr. and G. W. Geil. Preprint No. 25, Am. Soc. for Metals (7301 Euclid Ave., Cleveland, Ohio) (October 20, 1941).

Relief of residual stress in streamline tie rods by heat treatment. R. E. Pollard and F. M. Reinhart. Technical Note 832. (Nat. Advisory Com. Aeronautics, Washington, D. C.) (November 1941).

The technical cohesive strength of metals. D. J. McAdam, Jr. J. Applied Mechanics. Preprint No. 41 (American Society of Mechanical Engrs., 29 West 39th St., New York, N. Y.) (December 1, 1941).

A vacuum method of measuring the air content of fresh concrete. George L. Pigman. J. Am. Concrete Institute (7400 Second Blvd., Detroit, Mich.) **13,** No. 2, 121 (November 1941).

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